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NEBC MEETING NEWS

October 2003. Vice President Art Gilman introduced the night's speaker, Bill Patterson, from the University of Massachusetts, Amherst. Bill, who has been interested in fire ecology since his undergraduate years, is currently a National Park Service certified "Burn Boss," and also instructs The Nature Conservancy in burning techniques.

Bill noted that for over 60 years, Americans have been trained to follow the mantra of Smokey the Bear: forest fires are bad. Providing land managers and the public with the historical background of an ecosystem aids in convincing them to trust in the ability of fire to maintain that ecosystem. Historical records indicate that Native Americans practiced regular burning of the landscape. However, some people now believe that there has been some exaggeration as to how frequent and widespread the burning was. To investigate this, Bill and his team laid a series of 20 m^2 plots at the Cape Cod National Seashore (CCNS). These plots, monitored over the past 18 years, were subjected to combinations of the following treatments: burning/mowing during each growing season, at 1–4 year intervals, or leaving plots unburned. After 2–3 years, the plots that were burned annually had so little fuel remaining, it was difficult to even start fires in them. New species were not recruited with this burning regime, and the plots did not convert to grassland, indicating that although Native Americans may have burned land annually, they could not have been burning the same tracts of woodlands as frequently as has been assumed.

Determining an ecosystem's "fire history" can be difficult in New England, since there are so few older trees that scientists can examine for scarring patterns in order to estimate when fires occurred. One technique that has been successful is the examination of the sediment of pond cores. Using pollen grains and charcoal present in these cores, scientists have been able to determine the composition of ancient forests as well as the occurrence of fires.

To determine how best to manage the Atlantic white cedar swamp at Marconi Station on the CCNS, the only major population of this species on Park Service land in 1980, a core of the swamp peat was taken. The Park Service was concerned that with total fire suppression, the cedar was in danger of being replaced by red maple. The 1000-year-long core revealed that the cedar had become abundant only over the past 350 years, possibly due to the occurrence of a major fire. Prior to the fire, the population had fluctuated continuously in response to periodic fires, which probably originated in the upland. The amount of charcoal in the core indicated that these fires were large, and therefore too risky to

reproduce. Since the cedar continues to thrive without fire, it was decided that there was no need to harvest or burn the stand in the immediate future.

There are a variety of techniques now used to develop and implement a burn plan. Past fire occurrences are investigated with satellite photography, and burn crews frequently have helicopters to assist them. Crews sometimes use chemical-filled "ping pong balls" to start mini-fires before the main burn; sending in the ping pong balls ahead of time ensures that there are burned-out areas inside the targeted plot, which keeps the fire from spreading out of control. For safety reasons, Bill and other burn bosses have had to work closely with fire departments, and for most burns there is backup equipment present in case of emergency. The Air Quality Division of the Department of Environmental Protection monitors smoke production, further constraining the burning that can be done. Bill noted that he has never had a fire escape from the control of one of his crews, but is well aware of the nuisance that occurred when a seven-acre fire planned in Albany, New York a few years ago instead burned through 75 acres of land.

Bill shared some of the valuable experience he has acquired in his twenty years of practicing fire ecology. For many years, it was standard to burn only in the spring, and Massachusetts granted permits only for that time of the year. While working on Nantucket in 1983, his crew was granted a permit to burn in August, for a project to prevent shrub succession in sandplain grasslands. He has since learned that the best way to control many hardwood species is to cut or burn them in midsummer. At that time of year the fires are intense, but don't spread as fast as those set in the spring, reducing the chance of the fire escaping from the control of the burn crew. Bill ended his talk by recommending that land managers seeking to control shrubs and trees should employ a burning regime during the growing season; if land is burned during the dormant season, the treatment will have to be repeated annually just to maintain the status quo.

November 2003. Vice President Art Gilman introduced the night's speaker, Dave Houston. Dave, now retired, was a Principal Plant Pathologist at the Center for Forest Health Research, part of the U.S.D.A. Forest Service's Northeastern Forest Experiment Station. The title of his talk was "Beech-bark disease and its effects on the northern forest." His research on beech bark disease spans three decades, beginning in the 1960s.

Dave began by describing several interesting characteristics of beech trees (*Fagus* spp.). They have amazing longevity (400+ years), reproduce both sexually (they are prolific seeders) and asexually (by

root suckers), and can tolerate deep shade, allowing them to grow for years in the forest understory until a gap in the canopy allows them to thrive. Beech trees also have atypical bark, with only a thin layer of dead cells surrounding the inner living bark and cambium. This lack of a protective rhytidome barrier makes the bark of beech trees more susceptible to mechanical, fire, or insect damage.

Beech bark disease (BBD) is caused by a combination of two organisms: the beech scale insect (*Cryptococcus fagisuga*), and fungi from the genus *Nectria* (principally *N. galligena* and *N. coccinea* var. *faginata*). The first North American appearance of the beech scale insect was around 1890 in Nova Scotia, where it was introduced via imports of European beech trees. Over the next several decades the scale spread north, then west and south; multiple introductions are suspected. They can now be found throughout the northeastern United States, west to Michigan, and south as far as North Carolina. The scale insects are tiny, and are all female, reproducing parthenogenetically. The nymphs are mobile, seeking out bark fissures and callus tissue from which they can feed, using a long, probing stylet. Once established, the scale insects can increase rapidly, secreting a waxy "wool" that can cover the outside of the tree when conditions are favorable.

Injury to beech bark by scale insects is a necessary precedent to infection by *Nectria* fungi. While *N. galligena* is native, and may be present in a forest before the scale insects invade, *N. coccinea* var. *faginata* was introduced, and always follows the scale into a new habitat. Reproduction is both asexual and sexual. Red perithecia, the sexual fruiting bodies, produce ascospores, the primary infective propagules. Dave noted that scale infestation and subsequent fungal infection is often most abundant on the north-facing side of a tree.

The initial wave of the disease, where up to 80% of large, mature beech can be killed, is termed the "killing front." Following this is an "aftermath stage," in which the disease affects young trees of root sprout and seedling origin. Such trees are not killed quickly, as were their progenitors, and accumulate cankers and defects over time. In a study done to quantify the damage to beech trees in aftermath forests, a regional pattern of canker development was found. The pattern was correlated with cold winters and wet falls, which served to reduce scale populations. Diseased trees often exhibit bizarre bark patterns as cankers develop, and in turn, become refuges for further infestation and infection. After the talk concluded, curious attendees were able to view samples of infected trees.

Researchers are now focused on the potential exploitation of BBD-resistant beech. In one case, trees initially thought to be resistant were

actually being protected by crustose lichens that encased the trunk and prevented scale insects from feeding. During the search for resistant phenotypes, Dave uncovered a curious phenomenon: semicircles of trees that were all BBD-resistant. Though it was suspected that these trees were clones produced by root suckering, isozyme analysis showed that the trees were unique, that is, were derived from seed and probably shared a single parent. It turned out that the agents responsible for this pattern were blue jays. A blue jay, which can tuck up to 14 seeds from a single beech tree in its throat, will cache the seeds in a semicircle. Seeds that are not recovered may become founding populations, and if they produce root sprouts, larger groups of resistant trees can result.

While Dave was hoping to spend the greater part of his retirement "shepherding resistant genotypes into the forest," the work to develop BBD-resistant beech trees has been difficult. Researchers have been unable to easily propagate beech vegetatively (beech can be vegetatively propagated, but only with difficulty), and it is difficult to conduct control pollinations between desired genotypes. Dave concluded his talk by noting that the rising demand by foresters and arboreta for resistant trees will spur research over the next few years, and will hopefully yield successful results.

December 2003. Vice President Art Gilman introduced Arthur Haines as the night's speaker. Arthur is a plant biologist and field taxonomist working as a researcher at the New England Wild Flower Society (NEWFS). He spoke to the club about his current work for NEWFS: "The Herbarium Recovery Project: Surveying herbaria for species of regional conservation concern."

Arthur began by describing the project, a reevaluation of herbarium specimens of rare species and the creation of an electronic database of herbarium records. The study included examination of collections from 42 New England herbaria. Arthur noted the value of herbaria in providing botanists with voucher specimens that can be used for their distribution data as well as for morphological and genetic studies.

Records for more than 500 native tracheophytes were reevaluated and recorded for this massive study, in which species at all levels of conservation value were treated. Many of these species are categorized as Division 1 in the *Flora Conservanda*, indicating that they have fewer than 100 global occurrences. Examples include the Anticosti aster (*Symphyotrichum anticostensis*), found in New England only within the Aroostook River in northern Maine, and the globally rare northeastern bulrush (*Scirpus ancistrochaetus*). Examples of Division 2 species (fewer than 20

New England occurrences) included in the study are pale painted-cup (*Castilleja septentrionalis*) and Greene's violet (*Viola subsinuata*), native to western New England. Selected species from Divison 4, which have no extant New England occurrences (i.e., known only from historical records), included disjunct eyebright (*Euphrasia disjuncta*), the only herbarium record of which was lost in a fire. There were also species for which data were lacking, labeled as "Division Indeterminate." Examples include newly described species such as MacGregor's wild rye (*Elymus macgregorii*), as well as Wiegand's rush (*Juncus anthelatus*), which was recently given species status. Arthur induced hearty laughter from the crowd when he displayed a photo of one of the most peculiar specimens he came across: a cookie with an imprint of *Isotria medeoloides*, a Division 1 species. It was later explained by an audience member that the cookies were served at a student's thesis defense.

All data from the herbarium specimens, including annotations, have been recorded in a Microsoft Access database known as HERB. Over 18,000 records have been examined so far, and of these, about 1 in 8 (2095) had to be annotated, due to either misidentification or changes in nomenclature. Thus, in some cases, historical records of species occurrences have turned out to be inaccurate and species distributions have been corrected accordingly. Ranges have been expanded for some species: the survey resulted in the discovery of about ten new state records, including mare's tail (*Hippuris vulgaris*) in Massachusetts and bigseed alfalfa dodder (*Cuscuta indecora*) in Rhode Island. The ranges of other species have turned out to not be as extensive as previously thought: specimens of bayberry willow (*Salix myricoides*) were misidentified in all but one Maine county (Aroostook), and the recognition of hybrid *Lycopodiella* species means that species such as Marguerite's clubmoss (*L. margueritiae*) now have more restricted distributions.

The next step for the Herbarium Recovery Project is the delivery of the data from the HERB database to New England's Natural Heritage Programs. Field surveys will continue, to keep current species distributions up to date. Arthur ended his talk by pointing out the need for continued revision of *Flora Conservanda* and by noting additional rare species that require field and herbarium surveys to ascertain their status in New England. During the question and answer session that followed his talk, Arthur made note of the fact that herbaria are on the decline and would benefit by being credited by any author who found them to be critical for the work published in a manuscript.

—Jennifer Forman, Recording Secretary.